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"Ningen Ryoku": the Japanese Way in Inculcating Human Skill into Engineering Education

Rory Padfield *, Effie Papargyropoulou, Sabariah Baharun, M.J. Megat Mohd Noor, Chiken Kinoshita

Malaysia-Japan International Institute of Technology,UTM Kuala Lumpur, Jalan Semarak, 54100 Kuala Lumpur, Malaysia.

Abstract

At the newly formed Malaysia-Japan International Institute of Technology (MJIIT) based at Universiti Teknologi Malaysia (UTM) in Kuala Lumpur, the inspiration and philosophy is taken from the idea of inculcating a Japanese style of education into Malaysian engineering degree programmes. A central component of this approach is a human-centred curriculum with specific emphasis on soft skill development and the nurturing of strong environmental values. 'Ningen Ryoku' – translated as 'Human Skill' from Japanese – is a series of 2 credit courses which bachelor students will take alongside their core technical classes throughout their degree. This paper sets out the approach and practicality of the first Ningen Ryoku course for MJIIT Bachelor Degree Engineering Programme as it ran September 2011 to January 2012. Experience of the strengths, weaknesses and challenges of engaging first year students with largely non-technical knowledge and soft skills development are discussed. It is hoped this paper will serve as a platform for discussion on how Malaysian engineering departments can engage on student and human-centred issues.

Keywords: sustainability; human-centred curriculum; engineering; Japan

1. Introduction

The demands for engineers with abilities and attributes in two broad areas, namely technical skills and generic skills, are highly sought after in the workplace (see for e.g. McCray, 2001). The technical skill comprises a sound knowledge of disciplinary fundamentals; a strong grasp of mathematics; creativity and innovation; together with the ability to apply theory in practice. The generic skills denote the set of abilities that enable engineers to work effectively in a business environment: communication skills; team-working skills; and business awareness of the

* Corresponding author. Tel.: +603-261-54137
E-mail address: rory@ic.utm.my

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implications of engineering decisions and investments. It is this combination of skills that underpins the role that engineers should be able to comprehend and survive in the business world, such as exercising their expert knowledge in complex environments and be an agent of change providing the creativity, innovation and leadership necessary to meet new challenges.

As such, the development of these technical and generic skills has long been recognized and incorporated as integral goals of undergraduate education at UTM. Since 2006, rigorous efforts have been made to inculcate these generic skills amongst its undergraduate. Similarly, the same principle has been adopted into the curriculum of undergraduate programme of the newly established Malaysia-Japan International Institute of Technology (MJIIT) in UTM.

MJIIT situated at the UTM International Campus, Kuala Lumpur was established in 2010 as a government-to-government initiative between Malaysia and Japan. It aims to offer a novel Japanese-style education in Malaysia. The idea is based on intensive Research and Development activities as well as close collaborations between academics and students within research groups (known as iKohza) capitalizing on a highly productive work environment and with a strong sense of professional ethics. MJIIT works closely with Japanese universities and industries to create a distinctive work culture and employs a holistic approach in its programme offerings. It is hoped that the unique approach of a Japanese style education at MJIIT will help spur more innovation and technology development in Malaysia.

In this regard, the Japanese philosophy of education has been assimilated into the development of the curriculum for the two existing engineering undergraduate programmes offered beginning September 2011, namely electronic system engineering and mechanical precision engineering. The critical factors in promoting creativity and innovation amongst students are through the new paradigm in pedagogy known as Knowledge, Experience and Self-directed learning (KES) concept as depicted in Figure 1. In an ideal KES cycle, students are expected to acquire both knowledge and experience in the first three years of their study period mainly through formal teaching and learning activities. At the same time, a self-directed learning environment is inculcated in the early years progressively and eventually the students would be able to confidently lead their own learning independently.

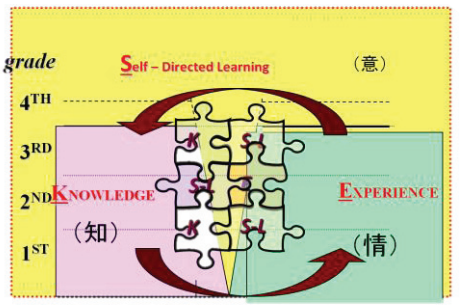

Fig. 1. Ideal KES cycle adopted in MJIIT curriculum

Ningen Ryoku is a Japanese word which means human skills. Such skills include leadership, decisiveness, challenging spirit, cooperativeness and adaptability. They are among the main skills necessary for the advancement of research and development activities. At MJIIT, four two-credits Ningen Ryoku courses have been specifically designed to inculcate these skills amongst its students. The courses are also aimed for the

students to appreciate the engineering profession and their expectation and contribution to the society. These courses include Energy and Environment Sustainability; Professional Ethics, Health and Safety; Introduction to Management of Technology and Innovation; and Entrepreneurship Management. In addition to these courses, other generic skills are also embedded throughout other courses in the curriculum.

In this paper, the conceptual approach and first-hand experiences of the first Ningen Ryoku course (Energy and Environment Sustainability) is discussed. This course was conducted from September 2011 to January 2012. The strengths, weaknesses, opportunities and suggestions on the improvement of the course are highlighted.

2. Putting Concepts into Practice

This first Ningen Ryoku course focusd on critical soft skills required for the workplace alongside an introduction to the key sustainability challenges facing our planet. The soft skills included team working, listening and participating in small groups, presentations skills using Microsoft Powerpoint, critical thinking, and an introduction to technical report writing. These skills are deemed important for engineering graduates going out into industry.

In line with a recent shift towards a deeper appreciation of environmental designs and challenges within undergraduate engineering syllabuses (Byrne and Fitzpatrick, 2009), the cognitive component of the course covered an introduction to sustainable development, key global environmental debates, and the present status of economy, energy and environment and understandings of their mutual relations. The course was tailored to meet the specific needs of engineers with emphasis placed on areas deemed most appropriate, such as technologies for sustainable development. A list of the course learning outcomes for Ningen Ryoku 1 is presented in Table 1 below.

Table 1. The Course Learning Outcomes for Ningen Ryoku 1 (Energy and Environment Sustainability)

No.	Course Learning Outcome
1	Explain, interpret and apply the concept of 'Sustainable Development'
2	Work effectively within a team to demonstrate understanding of the relationships between economy, energy and environment as well as the linkages to 'Sustainable Development'. Listen and actively participate in class discussions.
3	Demonstrate social, professional and ethical commitment to daily practises for the sustainable development.
4	Prepare and deliver presentation with the use of Powerpoint technology. Engage and give feedback on presentations. Prepare academic report with structure, content and referencing which elaborate student understanding of Sustainable Development.

The course ran as a series of weekly one-hour lectures over fifteen weeks. The lecture was followed by a three hour tutorial whereby skills and knowledge introduced during the lecture were developed in more detail and rigour. The tutorials focused on the social, ethical and professional commitments to sustainable development with further emphasis on team work, listening and participation, critical thinking, and communication skills. The course also involved a weekend fieldtrip to a local Nature Park which also incorporated as an assessment.

Three assessment methods were as follows: an individual report on a group research project called 'A Sustainable Campus', an individual presentation, and a group presentation during a weekend fieldtrip. The following section outlines the key cognitive and soft skills developed during the fifteen week course.

2.1. Knowledge focus: raising environmental awareness

As reflected in Table 1 above, the overarching aim of the knowledge aspect of the course was to raise the student's understanding of the leading environmental issues of our age. Whilst it was presumed there would be some prior level of understanding, it was felt important to build a basic foundation to their knowledge by focusing on some of the key concepts, issues and debates. In the early stage of the course, the concept of sustainable development was introduced and examined in relation to economic growth, energy and resource consumption, and environmental pollution. The three pillars of sustainability – social, economic and environmental – were elaborated to demonstrate their inter-relationships and integrity within a full and holistic understanding of sustainable development.

Reference was made to important global milestones such as the Brundtland Report (1987), the Rio Earth Summit, and the Kyoto Protocol. These inter-governmental initiatives helped to provide a broader perspective of the issues and the existing global actions to address sustainable development. In addition to emphasis on global actions and initiatives, local environmental issues that students could relate to (i.e. river pollution, air pollution, waste) were placed within the context of a global frame.

Climate change was acknowledged as one of the leading environmental issues to face current and future generations. Accordingly, the science of global warming, climate change impacts, and the debates surrounding climate change denial were discussed. Learning was facilitated by a video seminar session on Al Gore's documentary film 'An Inconvenient Truth'. Following the documentary, the students were asked to give their feedback on how the film depicted major global environmental impacts from climate change, actions to combat climate change, and climate change deniers.

Whilst local and regional examples focused primarily on the Malaysian and Asian context, examples were also drawn from a variety of developed and developing countries to provide an international perspective. One example was a seminar focussing on current renewable energy debates, with particular reference to nuclear energy options. Information on the respective merits of different sources allowed students to present arguments for and against different renewable energy options. The breakdown of Malaysia's energy sources was used to give context and a localised meaning to this discussion.

To align with the specific needs of first year engineering students, the course also touched on technological aspect of sustainable development. One lecture covered some of the different types of technologies required for renewable energy options such as solar, nuclear, hydro-electric and wind power.

Exposure to industry and outside speakers was applied as a means to facilitate learning and personal development. Guest speakers included a senior civil servant from the Malaysian Ministry of Green Technology, Energy and Water, a researcher from the National Institute for Environmental Studies (Japan) and a senior lecturer from Newcastle University (UK). The guest speakers provided an opportunity for engagement with professionals outside of MJIIT which was facilitated by questions and answer sessions following the lectures.

An important dimension of the raising awareness and appreciation of the environment was a weekend fieldtrip to Kuala Selangor Nature Park. Coordinated in tandem with a university programme called the First Year Experience (FYE) trip, the students spent two days immersed in an environmental education programme that included a boat trip to an estuary cockle farm, a bird watching activity and a half-day nature trial (see Figure 2 below). During the fieldtrip, an assessment exercise was incorporated. The exercise introduced the idea of differing and opposing stakeholder's position with regard to environmental protection versus local and national

development. Finally, the weekend provided an opportunity for a number of soft skill development which are discussed in the next section below.

Fig. 2. MJIIT students receiving a briefing from the Kuala Selangor Nature Park officer

The Sustainable Campus Research Project was in most cases the student's first 'research project' and involved engaging with UTM community, commitment to environmental responsibility, learning of research methods and technical reporting writing. The continuous learning experience was facilitated by the creation of a social media website to maintain and encourage engagement with and between students. A *Facebook* Page called 'Mottainai MJIIT' was established and students have able to share ideas, internet articles (including on-line newspaper reports and international reports) and comments on variety of different environmental related topics.

2.2. Skills focus: nurturing engineers for the future

Acknowledging the importance and necessity of soft skills to the professional and inter-personal development of engineering undergraduates, the course aimed at enhancing communication skills, team working abilities, critical thinking, formal presentation skills and technical writing (see the Course Learning Outcomes in Table 1). This was primarily undertaken in the weekly tutorial sessions where emphasis was placed on small group tasks and reporting back to the class on a frequent basis. These tasks helped to develop student's verbal communication skills, including forming opinions and aspects of critical thinking.

Critical thinking was developed by encouraging participation with lecturers in Question and Answer sessions, a video session, and classroom discussions to engage students with different angles of debate (e.g. nuclear and climate change debates). Furthermore, the Facebook Page provided a platform for discussion and interaction with critical thoughts which was an important part of the student centred learning component of the course.

Formal presentations and technical report writing skills were addressed in the following format: a one lecture covering the respective skill followed by a three hour tutorial session to develop the skills in small group task exercises. In terms of technical report writing, students were asked to write an individually worded executive summary of 150 words from a brief scientific article. This exercise helped to introduce the students to the style and format of technical report writing whilst simultaneously exposing them to published academic reports.

Furthermore, an introduction to library skills was undertaken during the first two weeks to expose students to how best to search for and access bibliographic material, whether stored electronically or as hard copies.

The fieldtrip to the local nature park provided further opportunity to develop the soft skills. The students were allocated into groups and asked to work in a team throughout the weekend. Students were being assessed throughout which served to motivate team working and encourage participation. The course culminated with an individual five minute presentation of the student's 'Sustainable Campus Research Project' report. The tutorials allowed students to work on their presentations skills throughout the semester before being assessed in this one-off presentation.

3. Reflections on the Course

The following sets some initial thoughts on the results and reflections of the course as divided into student grades and performance, lecturer reflections, and student feedback.

3.1. Student grades and performance

The grades for the course showed a relatively typical distribution of marks across the grades. For the 65 students, the distribution of marks was as follows: A (24%), B (43%), C (28%), D (5%), E (0%). The high proportion of A and B grades suggest the course is directed at the right level to enable students to score well. Moreover, the student's grades and performance relate directly to the amount of work put into the course and how the knowledge and skills were applied. Those with high grades worked hard and applied their knowledge and skills well; those with poor grades did not. For the future, consideration needs to be given to how to motivate the less performing students.

3.2. Lecturer's reflections

Overall, the lecturing staffs have a positive opinion of the course. Whilst clearly insufficient time within the semester to develop deeper knowledge and understanding of the cognitive and soft skills components, the weekly teaching format – one hour lecture plus 3 hour tutorial – provided opportunity to develop a baseline of knowledge and soft skills. Engaging students with critical discussion was at times challenging and therefore finding methods that could appropriately engage the students in a positive way will be important for future years.

Moreover, the lecturers felt that the majority of students responded well to the course, as noted by some positive feedback from the students (see below). Attitude started off well but did drop by some students, especially towards the middle and end of the course. The realisation that good marks would only be achieved through hard work did put some students off. On a related point, there was a sense by some students that good marks would be achieved regardless of how much work they needed to contribute. Furthermore, the fact that the course is a non-core course and only two credits was not a strong incentive to some students. For future years, it will be important to identify these students and encourage them to work hard throughout the whole semester.

As a final point, due to fact that this course was run for the first time, this was the first experience to the lecturers. Therefore, the lecturers are now in a better position to build on and improve on the course for future use.

3.3. Student feedback

On the whole, student feedback to the course was positive. Written feedback complimented the variety in teaching methods, which according to one student 'made the course more interesting'. Others noted that the lecturers gave confidence to the students in terms of their public speaking. The fieldtrip was also well received and therefore encouraging to note that the assessment exercise that dominated the fieldtrip did not take away from student enjoyment. Some students were less positive about the course, with a particular dislike of the regular speaking in front of groups within tutorials. This is most likely linked to a lack experience in terms of public speaking and their lack of confidence in speaking English.

4. Discussion

This section discusses the strengths and weaknesses to this Ningen Ryoku course in relation to the experience of teaching the course. Suggestions for enhancement, improvement and re-fining are proposed and discussed.

4.1. Strengths

- The weekly format of teaching (1 hour lecture followed by a three hour tutorial) offers a suitable balance to develop and nurture cognitive and soft skills. For example, the tutorials provided ample time to examine further the issues and skills raised in the lecture. In each tutorial, a different student was expected to give a short presentation which help to develop a confidence and familiarity in speaking and listening to others. In terms of the technical writing tutorials, for many of the students this exercise was a first attempt at academic writing and therefore time was taken to help improve and provide the basic principles. In future years, it will be important to continue this format of lecture followed by tutorials; having the lecture follow the tutorials would be far less effective as a teaching format.
- The mix of topics, guest lecturers, tutorial activities and fieldtrip allowed for a varied and interesting course to help develop environmental awareness. In total, there were eight different lecturers which included three guest speakers, two of whom were non-Malaysian. The exposure to international lecturers is more akin to a postgraduate course and therefore this course provides the students with an early experience of the full range of university teaching methods and styles. It is noted that the tutorials were facilitated by two MJIIT lecturers for all 15 seminars. This consistency allowed a student-lecturer rapport to develop as well as sufficient contact time for the MJIIT lecturers to adapt the classes to the different needs of the students.
- The emphasis on student centred learning, particularly in terms of reading outside of the course was facilitated by the Ningen Ryoku Facebook Page. It helped to bring to the student's attention to some of the conflicting and divergent debates regarding sustainable development, and was especially helpful in following up with particular topics raised in the tutorials. The Facebook Page is seen as a positive teaching tool and to be considered for future years and in other courses.
- The end of semester research project exposed the student to the challenges and requirements of doing research. It brought the students in contact with the wider UTM community, including university officials and administrators. The project provided the first groundings and experience of undertaking a research project. Participating in a related MJIIT research group (known as iKhozas) is an important part of their degree in later years and therefore it is useful to expose the students to a research project from an early stage.
- The fieldtrip to the Kuala Selangor Nature Park offered the opportunity to experience the natural environment at first hand. This helped to encourage a respect and responsibility for the environment which is a core objective of the course.

4.2. Weaknesses

- Individual motivation for the course was not always at the highest levels by some students throughout the duration of the course. This can be partially explained by the fact that the Ningen Ryoku courses are 'non-core' worth only two credits and also because the course is perceived as a softer and easier course as compared with the more technical core topics.
- It is noted that not enough emphasis was placed on some of the unique Japanese elements of an engineering curriculum. In particular, punctuality and respect for silence during presentations are areas for future improvement.
- The research projects were limited by the fact there was not sufficient time to brief the students on the research methodology. For future years, time can be used in the tutorials to explain the types of research methods to allow higher quality projects.
- Greater emphasis was not spent on time management, a key skill for graduates heading into the workplace. This was reflected by a number of late submissions of the research project and lecture punctuality. Emphasis on time management needs to done from the very first lecture to improve these skills in the future.

5. Conclusion

The Ningen Ryoku course is a relevant platform to nurture the critical soft skills and appreciation of the sustainability challenges facing engineers in the 21st century. The paper analysed the first Ningen Ryoku course at MJIIT by describing the overarching concept, highlighting the practical components of the course, and identifying the key strengths and weaknesses. The key strengths included the mix of topics, teaching format, and the inclusion of a fieldtrip which allowed for a varied and interesting course. One of the main weaknesses identified was the lack of motivation by some students due to the low number of credits associated with Ningen Ryoku courses and because it is perceived as an easier course compared with technical classes.

In terms of areas to re-examine for the future of Ningen Ryoku and arguably relevant for all MJIIT courses, there is a need for greater emphasis on some of the uniquely Japanese aspects of education, namely punctuality and time management. Whilst the students are exposed to a number of Japanese lecturers and consequently, receive directly a Japanese style of teaching and learning, more could be done to enhance the Japanese-Malaysia blend of education at MJIIT. Finally, by documenting the teaching and learning process of the Ningen Ryoku course, it is anticipated that this will help to realize quality improvement of the course and to ensure the real philosophy of Ningen Ryoku is materialized. MJIIT is committed to producing high quality engineers that can serve the nation with precision for sustainable development.

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